# Dependence Asymmetry and Joint Dependence in Interorganizational Relationships: Effects of Embeddedness on a Manufacturer's Performance in Procurement Relationships

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This study of the procurement relationships of two major U.S. auto manufacturers examines the effects of two dimensions of organizational interdependence on the performance of those relationships for the manufacturer: dependence asymmetry, the difference in actors' dependencies on each other in a dyadic exchange relationship, and joint dependence, the sum of dependence between actors in the relationship. Rather than focusing solely on dependence advantage and the concomitant logic of power, we focus on joint dependence, which operates through a logic of embeddedness. We examine how the effect of joint dependence on performance is mediated by specific elements of embeddedness: joint action, trust, and the quality and scope of information exchange. Results show that joint dependence enhances the performance of procurement relationships for manufacturers and that this effect is partially mediated by the level of joint action and the quality of information exchange between the partners. Decomposing dependence asymmetry into the conditions of a manufacturer's and a supplier's dependence advantage, we also find that while the manufacturer's dependence advantage diminishes its performance, the supplier's dependence advantage has a null effect. We discuss the implications of these findings for studies of interorganizational interdependence. ●

The concept of interdependence has received considerable attention from scholars studying interorganizational relations. Much of the early research on organizations considered interdependence between actors to be a liability that needed to be managed (Pfeffer, 1972; Benson, 1975; Pfeffer and Nowak, 1976; Provan, Beyer, and Kruytbosch, 1980) because unequal dependence would cause power imbalances likely to be detrimental for the weaker actor (e.g., Thompson, 1967; Stolte and Emerson, 1976). Emerson (1962), however, distinguished between joint dependence in a dyad, or the sum of actors' dependencies on each other, and dependence asymmetry, or the difference in actors' dependencies on each other. He labeled these constructs "cohesion" and "power advantage," respectively. Emerson used the term "power advantage" to specify the directionality of dependence asymmetry in the dyad and to indicate which one of the two actors held the dependence (power) advantage. For instance, the degree of an actor's dependence (power) advantage reflected the level of another actor's excess dependence on the first actor (i.e., net of the first actor's dependence on the other).

Emerson's structural dichotomy allows interdependence to vary simultaneously across both dimensions, treating interdependence as a non-zero-sum game. So, for example, an increase in dependence asymmetry, which gives a power advantage to one of the actors, could be coupled with a simultaneous increase in joint dependence. Given this early non-zero-sum conceptualization of interdependence, it is puzzling that, with few exceptions, most subsequent research has been drawn only to the implications of dependence asymmetry and its related power dynamics. By grounding itself primarily in a logic of power, research on interdependence has omitted other possible logics that may also affect


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action. In particular, it has ignored the logic of embeddedness, which arises from joint dependence and which can also operate in exchange relationships.

The logic of embeddedness suggests that higher levels of joint dependence necessarily increase the depth of economic interaction between exchange partners, jumpstarting a stronger relational orientation (Mizruchi, 1989; Zaheer and Venkatraman, 1995; Uzzi, 1996, 1999). This effect stems both from the infusion of sentiment into highly dependent relationships, leading them to become less instrumental (cf. Abel, 1930; Lawler and Yoon, 1993), and from the more calculative rationale of actors who now have a higher stake in maintaining a smooth relationship (e.g., Mizruchi, 1989; Heide and Miner, 1992). The increased relational orientation in turn results in increased levels of joint action, higher trust between partners, and a more advantageous information exchange in the dyad.

The prior focus of researchers on dependence asymmetries and the underlying logic of power have drawn scholarly attention to the role of structural preconditions such as dependence asymmetries in exchanges in shaping the actors' abilities to appropriate value in exchange relationships. Although this focus led to a large body of research on how actors benefit from being in a position of power and claiming greater value in a distributive process, it overlooked the question of how different facets of interdependence may have an impact on the total value created in the relationship and affect the performance of the exchange partners.

In the few organizational studies in which joint dependence has been considered, the focus has been on the dynamics associated with the logic of power in interorganizational relationships. In a recent study, Casciaro and Piskorski (2005) drew attention to the dichotomy between dependence asymmetry and joint dependence, examining how each of these facets influences the power-restructuring activities of firms; in particular, they studied how different facets of interdependence contribute to a firm's ability to manage external constraints stemming from dependence. They argued that although both dependence asymmetry and joint dependence create a motivation for absorbing constraints resulting from dependence, joint dependence provides weaker firms with a greater ability to deal effectively with the resistance of a more powerful partner and to successfully absorb the constraints through a merger. Thus, while Casciaro and Piskorski provided a compelling case for the role of different facets of dependence in constraint absorption, they did not focus on the two different facets of interdependence in terms of their alternative logics of action and their implications for the aggregate performance of exchange relationships.

Scholars studying interdependence in sociology (e.g., Emerson, 1962, 1964) and social psychology (e.g., Thibaut and Kelley, 1959; Kelley and Thibaut, 1978) were among the first to draw attention to the joint form of dependence in interpersonal relationships (Lawler and Yoon, 1993, 1996). This concept and others based on it were extended to the interorganizational context by scholars examining marketing channels

and the behavioral dynamics in those relations (e.g., Kumar, Scheer, and Steenkamp, 1995, 1998). Nevertheless, the focus of organizational scholars has remained on understanding the underlying power dynamics in interdependent exchange relationships. As a result, many of these studies have continued to examine the implications of partners' joint dependence through the prism of power and influence, focusing on such consequences of dependence asymmetry and joint dependence as the use of power and punitive actions (Kumar, Scheer, and Steenkamp, 1998), coercive versus non-coercive strategies (Gundlach and Cadotte, 1994), conflict levels (Kumar, Scheer, and Steenkamp, 1995), constraint absorption (Casciaro and Piskorski, 2005), and residual feelings of conflict (Gundlach and Cadotte, 1994). The logic of embeddedness underlying joint dependence was thus not fully separated from the logic of power and, as a result, was much less fully explicated; moreover, this logic's implications for firms' performance in exchange relationships have yet to be considered.

A number of studies of the automotive industry have also examined issues of interdependence by focusing on power. Scholars have described how auto manufacturers can exploit weaker suppliers in this industry to obtain superior economic returns (Perrow, 1970; Dore, 1983). In line with other theorists who argued that the key in purchasing was to "offset or surmount the sources of supplier power" (Porter, 1980: 123), scholars have focused on manufacturers' ability to extract superior value by squeezing suppliers in negotiations and deriving benefits from advantageous value appropriation. In some studies, however, scholars have also hinted at the importance of joint dependence in generating valuable benefits for manufacturers in their procurement relationships. Descriptions of relationships among Japanese automotive assemblers and their suppliers provide compelling evidence of the benefits of jointly dependent ties to manufacturers. In one of the earliest accounts, Dore (1983) emphasized the non-adversarial nature of jointly dependent ties. Similarly, in a qualitative account of relationships between Honda and its suppliers, MacDuffie and Helper (1997) showed how the tight collaborations between the manufacturer and suppliers benefited Honda through mutual adjustment and interorganizational learning and allowed both parties to reap superior economic returns. The closeness and high mutual dependence of Japanese firms' procurement ties led some scholars to identify these traits as a source of competitive advantage for the Asian companies over their American counterparts (Dyer, 2000). Current and future relationships between automotive manufacturers and suppliers are no longer seen merely as bargaining tugs-of-war driven solely by value appropriation motives; rather, they are now viewed as representing effective symbiotic coexistence wherein manufacturers aim for superior joint value creation as a foundation for their competitiveness. Thus these prior accounts hint at the importance of joint dependence for the efficacy of procurement relationships and suggest some of the likely underlying behavioral dynamics that make this possible. Here, we take a step further by making systematic connections between joint dependence, the underlying logic of action trig-

gered by those structural conditions, and actors' performance in those procurement relationships.

The study reported here is based on fieldwork and survey data on manufacturer-supplier procurement relationships in the U.S. automotive industry. This empirical setting is especially conducive to examining the performance effects of joint dependence because it is characterized by a high level of sequential interdependence (Blau and Scott, 1962: 219; Thompson, 1967). Building on the idea advanced by early social exchange theory and social psychological research that dependence may affect partners' orientations in a relationship (Kelley, 1979; Lawler and Yoon, 1996) and on research highlighting certain performance advantages of embedded interorganizational exchanges (Eccles, 1981; Provan, 1993; Gulati, 1998, 2007; Uzzi and Gillespie, 2002; Gulati and Wang, 2003), we consider the influence of joint dependence on the potential value creation for and performance of procuring firms, as well as the mechanisms through which such effects may occur.

## THE EFFECTS OF INTERDEPENDENCE ON PERFORMANCE

### Dependence Asymmetry and the Logic of Power

Organization theorists, having long recognized the importance of the external environment, have characterized organizations as open-system structures that seek to manage their levels of dependence on the environment (Stinchcombe, 1959; Thompson, 1967). Resource dependence theory has subsequently developed from this early work (e.g., Pfeffer, 1972; Pfeffer and Salancik, 1978). Organizations have been portrayed in this arena as entities whose survival depends on their exchange of resources with multiple environmental elements, including suppliers, buyers, competitors, and regulators; organizations have also been viewed as vulnerable entities often affected by the uncertainty of such environments.

Much of the research on interorganizational relationships among interdependent actors has been grounded in the interrelated notions of power and control. As Pfeffer and Salancik (1978: 52) argued, "The concentration of power is inevitable," and ". . . to the extent that the interests of one party cannot be achieved without other parties, concentration is necessary." They defined interdependence as a phenomenon that "exists whenever one actor does not entirely control all of the conditions necessary for the achievement of an action or for obtaining the outcome desired from the action" (Pfeffer and Salancik, 1978: 40). By this definition, interdependence and its implications are closely identified with power. This early work set the tone for subsequent research on organizational interdependence. As such, relationships characterized by balanced dependence were viewed as rare. If an actor was more dependent on its exchange partner, the resulting net-positive dependence on the partner, or the partner's dependence advantage, was construed as the source of the partner's power; similarly, if an actor's net dependence was negative, then the actor was believed to have the dependence advantage and thus to be in a position of relative power (Emerson, 1962). It is precisely in such situations of

dependence asymmetry and their resulting power disparities that adversarial action is more likely.

The U.S. automotive industry, which "has been characterized by decades of adversarial buyer-supplier relations" (Mudambi and Helper, 1998: 789), has served as an exemplar of interorganizational power plays. Automotive manufacturers have historically maintained large numbers of suppliers to play them off against each other for price concessions, purposefully kept them at arm's length to maintain advantage, and strategically allocated purchasing volumes to keep them in line, thereby perpetuating the adversarial nature of these interactions (Shapiro, 1985). Suppliers, in turn, have exploited manufacturers' weaknesses through deliberate opportunistic behavior, leading scholars to comment on how the resulting animosity prevented automotive manufacturers and their suppliers from developing a sense of informal commitment in their procurement relationships, often irrespective of the level of formal integration (Mudambi and Helper, 1998).

Participants in such adversarial procurement relationships were warned to monitor their respective power positions. The classical theorizing behind this is that an actor possessing a dependence advantage—and hence the more powerful actor in a relationship—will increase its use of adversarial tactics because of a decreased fear of retaliation, thereby positioning itself to capture greater value in the relationship at the expense of the weaker or dependence-disadvantaged actor (Blau, 1964). This reasoning suggests that the degree of a manufacturer's dependence advantage would enhance its performance in exchange relationships with suppliers. In corroboration, findings from several studies of the automotive industry showed that asymmetrically dependent suppliers were likely to be squeezed by manufacturers for profits in economically difficult times (Dore, 1983). In one extreme case, auto manufacturers even audited weaker suppliers to ensure that the latter would earn no excessive profits on exchange transactions, thereby redistributing the value in the relationship in their own favor (Perrow, 1970).

Though it is reasonable to expect manufacturers to fare better when they are endowed with power in the relationship, the logic of differential power and the concomitant differences in their relative abilities to appropriate value suggest that when the supplier holds the dependence advantage, the performance of the manufacturer would suffer. Underlying this argument is the concept of value appropriation: the performance benefits of the stronger, dependence-advantaged firm are expected to come at the expense of the weaker, dependence-disadvantaged partner (e.g., Cook, 1977; Pfeffer and Salancik, 1978; Aldrich, 1979; Kim, Hoskisson, and Wan, 2004). The putative performance losses for the weaker actor in such situations were of such great concern that scholars put forward a wide variety of strategies designed to alleviate the asymmetric dependence of weaker actors in exchange relationships. Suggestions ranged from internal adaptation, such as buffering operations by maintaining inventories (Thompson, 1967), to cooptation through the formation of interlocking directorates (Burt, 1980; Burt, Christman, and Kilburn, 1980) and absorption through merger of the uncertainty

and risks coming from the influence of a more powerful organization (Pfeffer, 1972; Pennings, 1981; Palmer et al., 1995). Taken together, our arguments suggest the following hypotheses:

Hypothesis 1a: A manufacturer's dependence advantage is positively related to its performance in the procurement relationship.

Hypothesis 1b: A supplier's dependence advantage is negatively related to the manufacturer's performance in the procurement relationship.

## Joint Dependence and the Logic of Embeddedness

Though Emerson (1962) focused almost exclusively on power and asymmetries in dependence, thereby accentuating the importance of balanced dependence, he also hinted at the importance of joint dependence and its concomitant logic of embeddedness. Emerson suggested that even if two separate relationships are each perfectly balanced in terms of their actors' dependence levels, they may have different behavioral implications if they are balanced at different levels of dependence: "Consider two social relations, both of which are balanced but at different levels of dependence (say Loeb and Leopold, as compared with two casual friends). [In situations of high joint dependence] it might even be meaningful to talk about parties being controlled by the relation itself" (Emerson, 1962: 34).[1] Emerson's reference to the relationship's controlling nature reflects the logic of embeddedness stemming from joint dependence, which results in each partner's giving heightened attention to the responses and attitudes of the other, such that the quality of the relationship becomes one of the main determinants of a satisfactory business tie. In other words, the structural parameters of the relationship subsequently shift the dispositions of the actors in it (Marsden, 1981).

In accordance with these ideas, social psychological research has also found that parties who depend heavily on a relationship are more likely to interpret ambiguities in their partners' behaviors in a positive rather than a negative light (e.g., Murray, Holmes, and Griffin, 1996). More importantly, this research has highlighted how structural patterns of interdependence could account for the emergence of relationship-specific motives. It has demonstrated, for instance, that an individual's high level of dependence on a partner may generate a high level of commitment to the relationship, thereby leading to the adoption of an orientation toward the long term, effective conflict resolution, and the willingness of parties to forego immediate self-interest for the benefit of the relationship (Kelley, 1979; Rusbult et al., 1991). Lawler and Yoon (1993, 1996), in a series of experimental studies, put forward a compelling argument for these links by showing how high levels of mutual dependence foster increased cohesion and affective commitment in the relationship by enhancing the frequency of exchange agreements.

By a similar logic, joint dependence can imbue interorganizational exchanges with increased cohesiveness, and the resulting logic of embeddedness may then perpetuate

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Emerson was referring to the infamous 1924 murder case in which Richard Loeb and Nathan Leopold acted as accomplices. This negative analogy once again attests to the critical stance toward interdependence in much of the prior research.

increased social solidarity and cooperation in such business relationships (Provan, 1993; Gulati and Gargiulo, 1999). The interests of actors in such a regularized structure of exchange relations are increasingly likely to affect—and be affected by—the interests of their business associates as they begin to develop a shared understanding of the utility of mutually beneficial behavior (Marsden, 1981; Lawler and Yoon, 1996; Uzzi, 1997; Lawler, Thye, and Yoon, 2000). Such shared understanding often results in the emergence of a form of "relational governance," a term that refers to the rich and deep interactions, going well beyond contractual obligations, among firms in highly dependent relationships (Eccles, 1981; Larson, 1992; Zaheer and Venkatraman, 1995). This mutualistic orientation is further reinforced by the "inexpensive and flexible yet penetrating" moral and social control stemming from highly dependent relationships (Larson, 1992: 96).

The work of several other researchers provides additional evidence for the impact of partners' dependence levels on the nature and quality of their interaction (Gulati and Wang, 2003). Mizruchi (1989), for instance, demonstrated that when two industries were highly interdependent, such that firms of one industry engaged in high-volume exchange relationships with those of the other while having a limited number of alternative exchange partners, these firms tended to exhibit similar patterns of political behavior (see also Mizruchi, 1992). Similarly, Provan and Gassenheimer's (1994) study of U.S. furniture dealers and their relationships with suppliers demonstrated that more powerful suppliers were much less likely to exert influence over dealers' profit margins, volume quotas, acceptance of new product lines, and territory restrictions when they were in embedded relationships. Other studies in the U.S. apparel industry (Uzzi, 1996) and in the U.S. banking industry (Uzzi and Gillespie, 2002) also showed how a more cooperative orientation stems from high levels of joint dependence. These claims parallel recent dynamics in the U.S. automotive industry. In the last two decades, American automotive manufacturers have increasingly been trying to emulate the success of their Asian counterparts by increasing the total volume of materials procured through outsourced relationships and fostering tighter collaborations with external suppliers (Helper and Sako, 1995), but this is in stark contrast to the earlier normative recommendations to manufacturers "to spread purchases among alternate suppliers in such a way as to improve the firm's bargaining position" (Porter, 1980: 123–124) and implies that there are ways in which manufacturers could benefit from jointly dependent relationships.

The implications of joint dependence for the performance of a manufacturer's procurement relationships contrast significantly with those of the logic of power, which focuses exclusively on actors' abilities to appropriate value in exchange relationships. The logic of embeddedness that underlies enhanced joint dependence suggests that the increased quality of interaction between jointly dependent partners would enhance the relationship's value-generating potential, subse-

quently driving both actors' performance in it, for a variety of reasons.

First, because highly dependent relations elevate partners' levels of identification with each other, their values, attitudes, and goals will tend to converge (French and Raven, 1968; Turner, Brown, and Tajfel, 1979; Mizruchi, 1989). Partners in such relationships tend to develop mutual empathy and a focus on joint success, embracing a long-term horizon for the relationship. Furthermore, as a result of their increased dependence and joint involvement, dyadic partners may also become more structurally similar (DiMaggio and Powell, 1983). The attitudinal convergence makes communication and negotiations in the relationship less conflictual, while structural congruence reduces some of the operational frictions, helping actors avoid unnecessary transaction costs.

Second, because of increased levels of empathy and the desire to avoid the higher costs generated by disruptions of highly dependent relations, actors in such relations are likely to prefer non-coercive relational tactics to coercive strategies (Gundlach and Cadotte, 1994). Reduced use of punitive actions, coupled with reliance on non-adversarial rules of engagement, facilitates the development of a stable business relationship, which in turn promotes its continuity (Raven and Kruglanski, 1970). Because opportunistic behavior would lead to a prohibitively expensive sacrifice of future exchanges, such continuity has been shown to enhance the levels of cooperation in an exchange relationship (Stinchcombe, 1986; Heide and Miner, 1992; Subramani and Venkatraman, 2003), setting the stage for superior value creation.

Finally, despite the increased frequency of operational frictions that generally characterizes highly dependent ties, parties' residual feelings of conflict have been shown to decrease at higher levels of joint dependence (Lawler, 1993; Johnson, Ford, and Kaufman, 2000). Jehn (1995) found that the negative impact of relational conflict driven by actual or perceived personality incompatibilities decreases at higher levels of interdependence. Thus, conflicts in highly dependent relationships tend to be less severe and less persistent, making those confrontations that do occur between exchange partners less detrimental economically and emotionally.

Taken together, the arguments above suggest that a manufacturer's procurement relationships characterized by joint dependence will be governed by the logic of embeddedness. The logic of embeddedness, in turn, entails reduced transaction costs, greater resilience in the face of relational hazards, and increased opportunities for value creation. We therefore expect manufacturers to reap superior performance benefits in relationships that involve joint dependence:

Hypothesis 2: Joint dependence is positively related to a manufacturer's performance in the procurement relationship.

Acting as a multifaceted social overlay of exchange relationships, relational embeddedness improves the robustness of the relationship, boosting the total value generated in it and enhancing a manufacturer's performance. This argument

implies that it may not be the level of joint dependence per se but, rather, its relation-based covariates, engendered by the circumstances it creates, that lead to a manufacturer's enhanced performance in economic exchanges. Relational embeddedness has been portrayed as a multifaceted construct comprising elements classified into three broad domains: joint action, trust, and fine-grained information transfer (Granovetter, 1992; Larson, 1992; Uzzi, 1997). Each of these elements can serve as a critical pillar of the mutualistic and cooperative orientation that emerges in highly dependent relationships. Therefore, we expect each of these mechanisms to partially mediate the relationship between joint dependence and performance.

Following Baron and Kenny's (1986) recommendations for testing for mediation, we first establish the relationships between joint dependence and each of the three core mediating mechanisms and explicate how each affects performance, thus mediating the performance effect of joint dependence. Baron and Kenny's (1986) framework for mediation testing also mandates establishing a relationship between joint dependence and performance. Our development of hypothesis 2 in effect constitutes the theoretical prerequisite to establishing this relationship empirically.

### The Mediating Role of Joint Action

Heightened cooperation through joint action is an important element of successful exchange relationships, especially those characterized by enhanced mutual dependence (Lorenz, 1988). Heide and John (1990) broadly defined joint action as the degree of interpenetration of organizational boundaries. In line with this definition, we view joint action as the degree of dyadic cooperation and coordination across a wide array of organizational activities, such as design, cost control, and quality improvement. Joint action could also involve developing bilateral solutions to relational and operational problems. It is likely that the effect of joint dependence on a manufacturer's performance will be mediated by the extent of joint action the two actors undertake.

Because increased joint dependence facilitates the structural and attitudinal convergence of business partners (DiMaggio and Powell, 1983; Tajfel and Turner, 1986), they become predisposed to carrying out jointly coordinated activities and can develop greater overlap in their strategic goals, in part because they face fewer structural impediments to the joint pursuit of such goals. This process is facilitated by the less conflictful interaction found in relationships with high joint dependence (Kumar, Scheer, and Steenkamp, 1995; Johnson, Ford, and Kaufman, 2000). Finally, a high level of joint dependence in a dyad also fosters the emergence of relational behavior and behavioral solidarity, creating an environment conducive to the pursuit of jointly coordinated activities (Zaheer and Venkatraman, 1995; Lusch and Brown, 1996).

Joint action, in turn, should be related to higher levels of value creation in the relationship and a manufacturer's concomitant performance, mediating the effect of joint dependence on a manufacturer's performance in exchange relationships. High levels of joint action have been shown to

increase the level of partners' behavioral flexibility in the dyad and their ability to resolve operational frictions (Uzzi, 1997). Similarly, high levels of joint involvement and coordination are frequently coupled with high levels of motivation, leading to the preferential use of an effective strategy of voice as opposed to exit (Hirschman, 1970; Helper, 1988). Relying on joint problem resolution and on voice strategies is likely to generate effective relationship-specific solutions, which can obviate the need for formal methods of conflict resolution, with their attendant financial and reputational costs. Furthermore, because automotive manufacturers require moderate to high levels of coordination in procurement ties to develop and implement technological innovation, a high level of joint action has been shown to help introduce new product features faster and often ahead of the competition (Helper, 1988; Clark, 1989). Such positive exchange features arising from joint action are likely to enhance the overall robustness of the relationship and the manufacturer's performance in it:

Hypothesis 3: Joint action will partially mediate the effects of joint dependence on a manufacturer's performance in the procurement relationship.

## The Mediating Role of Trust

Interorganizational trust is also likely to mediate the effect of joint dependence and the logic of embeddedness on a manufacturer's performance (Gulati, 1995; Zaheer, McEvily, and Perrone, 1998). Trust can be defined as the expectation that another organization may be relied upon to fulfill its obligations, to behave predictably, and to act and negotiate fairly even when the possibility of opportunism is present (Zaheer, McEvily, and Perrone, 1998). High levels of joint dependence create an environment that cultivates and perpetuates trust and commitment by making it prohibitively expensive for partners to engage in opportunistic behavior. In essence, relationships characterized by high joint dependence foster a culture of "mutual reliance" in which exchange partners exhibit a decreased proclivity for opportunistic behavior (Williamson, 1985: 190) because the costs of such behavior are likely to be passed back to the initiator as a result of its own dependence on the other party. Additionally, research suggests that actors who are highly dependent on others may strive to alleviate the anxiety this state generates by perceiving their counterparts as more trustworthy. Because they are more likely to be positively biased in assessing their partners' trustworthiness, they are also more likely to engage in acts of trust, inducing reciprocal acts of trust from their partners and fostering a higher level of mutual trust in the relationship (Weber, Malhotra, and Murnighan, 2005). Similarly, partners willing to stay committed to a limited set of exchanges with high levels of dependence, signaling their dedication to trustworthy behavior, evoke similar expectations and behaviors from their counterparts, fostering a culture of trust (Zand, 1972; Subramani and Venkatraman, 2003).

There are numerous ways in which trust enhances actors' levels of performance in exchange relationships. First, trusting relationships serve as a counter to the problem of moral hazards, reducing the need for contractual safeguards, along

with their associated costs (Ring and Van de Ven, 1994; Gulati, 1995; Lincoln and Gerlach, 2004). Second, with increased trust, parties become more open, show less defensive behavior, and accept more influence from their partners in the selection of goals, choice of methods, and evaluation of progress (Zand, 1972). Finally, trust may further benefit the relationship in that exchange partners may not hesitate to demand of each other legitimate adaptations to new internal and external contingencies, having relinquished the fear that these demands will be perceived as illegitimate; as a result, the dyadic relationship is likely to become more flexible and innovative (Lorenz, 1988). Thus, in addition to generating benefits on the cost side by absorbing relational uncertainty (Barney and Hansen, 1994; Gulati, 1995), trust may help partners enhance the transaction's value through exploration of new coordination techniques, as well as product and process innovation (Zajac and Olsen, 1993; Zaheer, McEvily, and Perrone, 1998).

**Hypothesis 4:** Trust will partially mediate the effects of joint dependence on a manufacturer's performance in the procurement relationship.

### The Mediating Role of Information Exchange

Another relational mechanism likely to mediate the effect of joint dependence on performance is the quality of information exchange, in terms of its detail, accuracy, and timeliness, and the scope of information exchange, in terms of the types of information exchanged. Prior research suggests that manufacturers who work with smaller numbers of suppliers and thus develop more dependent relationships with them can better manage their information flow with those suppliers (Eccles, 1981). This is hardly surprising given the limited attention capacity of firms' managerial personnel (Simon, 1978). When focused on a small set of highly dependent ties, firms are able to broaden their coverage of information in the relationship (Larson, 1992). Again, this expansion of the scope of information exchange is related directly to the limited attention capacity of organizational agents (Simon, 1978), especially those in charge of critical managerial decisions; for manufacturers with fewer suppliers, this attention is focused on a few key relationships instead of being diffused and fragmented across many suppliers. Because organizational agents are more likely to engage in a proximate search, linking potential courses of action to the existing relationship (Cyert and March, 1963), they are more likely to take advantage of the improved information management capabilities by broadening the scope of information exchange within existing relationships.

As organizational decision makers increasingly channel their attention toward the relationships on which they rely most heavily, they are more likely to be concerned about the quality of information exchanged (Ocasio, 1997). In jointly dependent relationships, all these trends are further reinforced by the emergence of behavioral norms that lead to enhanced bilateral information exchange (Heide and John, 1992). Increased normative support makes parties more open to communication and less inclined to withhold critical informa-

tion, which not only enhances the scope of information exchange (Zand, 1972) but also encourages the exchange of unique fine-grained information, providing greater accuracy and detail to the information exchange (Uzzi, 1997). Evidence suggests that effective information sharing is crucial for actors' performance and is one of the most critical prerequisites for a successful relationship (Dyer, 1996, 1997). Macaulay (1963) showed how expectations and commitments in interorganizational relationships are not always codified and may often exist only implicitly, in the form of moral or psychological contracts. In this context, the information exchange's level of detail, accuracy, and timeliness and its scope can prove critical for the convergence of expectations and assumptions about partners' prerogatives and obligations that are not formally specified in the contract governing the exchange relationship. In addition, partners in dyads with highly detailed and accurate information transfer may gain a competitive edge by elevating their cognitive capacities and information processing abilities from those of bounded rationality to expert rationality (Uzzi, 1997). The enhanced quality and scope of their information exchange enables them to process information in composite chunks as opposed to disparate pieces, providing unique advantages that in turn have an impact on the performance of exchange relationships. Such expert rationality allows firms to see and generate more integrative interorganizational solutions and thus raise the standards for acceptable alternatives in a satisficing search (March and Simon, 1958). We thus hypothesize:

Hypothesis 5: The scope and quality of information exchange will partially mediate the effects of joint dependence on a manufacturer's performance in the procurement relationship.

## METHOD

### Data

The analysis presented in this paper is based on fieldwork, followed by a survey of lead buyers of components that go into the assembly of an automobile at the Ford Motor Company and at the Chrysler Corporation. Prior to launching the survey, we conducted a total of 37 interviews (16 at Chrysler and 21 at Ford). The initial interviews were exploratory and open ended and were intended to clarify the nature of procurement relationships and the dynamics of interaction between manufacturers and suppliers. In later interviews, we sought clarification on our central constructs of dependence, trust, joint action, quality and scope of information exchange, and performance. The unit of analysis for the survey instrument is the component, with each survey respondent providing data on a particular component that goes into an automobile, as well as data on two of the largest suppliers for that component. This sampling approach is akin to one used by Monteverde and Teece (1982) in their seminal study of sourcing in the automotive industry. Drawing on previous studies of the automobile sector and discussions with informants in the automobile industry, we used a list of 120 components that go into most automobiles. We verified the comprehensiveness of this list with several executives in the industry and also by comparing it with component lists used by the

firms to monitor the quality of their own parts. For each component, senior managers at the two automobile assemblers supplied the names of buyers with oversight for the sourcing of that component. In addition, the controller's office in each company verified the expert status of each survey respondent.

We took several steps to ensure a good response rate for the survey (Fowler, 1993), ranging from having senior management endorse the project to conducting multiple follow-ups with non-respondents. Sixty-four buyers responded from Ford, and 67 buyers responded from Chrysler, representing response rates of 53 percent and 56 percent, respectively, and a total response rate of 55 percent. We examined the nonresponse bias by comparing the characteristics of the components for which responses were received against those for which no response was received for two key component characteristics—type of sourcing and engineering complexity (Monteverde and Teece, 1982)—using the Kolmogorov-Smirnov test (Siegel and Castellan, 1988). We found no significant differences between the categories of respondents and non-respondents. The respondents provided information on 262 exchange relationships. Whenever possible, we tried to validate the survey-based measures by checking their congruence with their objective underlying indicators. We eliminated 81 observations with missing data and 30 observations on components supplied in-house, leaving 151 observations for relations with 113 unique suppliers.

### Measures

To ensure the reliability and discriminant validity of our constructs, we relied primarily on items used in prior research and subjected them to a thorough pretest. We eliminated items that were unclear, ambiguous, or led to perceived overlaps in constructs. To control for the magnitude of the common-method variance problem characteristic of survey-based research designs, we conducted Harman's (1967) single-factor test, which generated a clear multifactor solution with the most influential common factor explaining less than 20 percent of variation in the data, far below the recommended 50 percent threshold (Podsakoff and Organ, 1986). We thus concluded that common method variance was not a severe problem in our data.

*Joint dependence.* To create a measure of joint dependence, we conducted an exploratory factor analysis of thirteen items reflecting different aspects of the supplier's and manufacturer's dependence. To be consistent with prior research, we chose these items to reflect (1) the dependence resulting from the magnitude of exchange (e.g., Pugh et al., 1969; El-Ansary and Stern, 1972; Pfeffer and Salancik, 1978), (2) the concentration of exchange measured through both the number of exchange partners and the fraction of business done with a partner (e.g., Burt, 1982; Kumar, Scheer, and Steenkamp, 1998), (3) the availability of alternative sources of exchange as reflected in the degree of the replaceability of the incumbent partner (e.g., Brass, 1984; Kumar, Scheer, and Steenkamp, 1995), and (4) the magnitude of transaction-specific investments (Heide and John, 1988), among other

dimensions of dependence. To control for the possibility of a perceptual bias, we thoroughly pretested our items, aiming to focus our respondents' attention on clearly specified dimensions of dependence. For reasons of confidentiality, we could not obtain archival measures of dependence from the manufacturers, but we made efforts to ensure the reliability of our self-reported dependence items in the survey by drawing a random subsample of 20 percent of completed surveys (53 observations) and asking our contacts at each of the firms to compare survey responses with their internally collected archival measures of dependence. This comparative exercise was done for three items measuring dependence: the dollar volume of the focal component purchased from the supplier, the dollar volume of all components purchased from the focal supplier, and the percentage of the manufacturer's component requirements supplied by the supplier. The first two items were captured with a categorical survey item and were hence verified by cross-checking whether the actual dollar volume fell in the interval marked by survey respondents. The third item reflected a continuous variable and was correlated with the actual percentage of a manufacturer's needs met through the focal supplier. The accuracy of classification for the first two items and the correlation coefficient between the survey item and the true measure for the third item both exceeded .90, suggesting the high reliability of our self-reported measures. Some scholars have advocated using such perceptual measures of dependence, given that actors' behaviors in the context of power-dependence relations are ultimately driven by their definitions of the situation (Emerson, 1976; Astley and Zajac, 1990).

Exploratory factor analysis, which is the appropriate statistical technique for measuring unobservable theoretical constructs with reflective indicators, was used to create measures of the manufacturer's and supplier's dependence (Kim and Mueller, 1978; Zeller and Carmines, 1980). Common factor analysis followed by the varimax rotation procedure yielded a two-factor solution, with factor 1 reflecting a supplier's dependence ($D_S$) and factor 2 reflecting a manufacturer's dependence scales ($D_M$).[2] Taken together, the factors explained over 76 percent of the variance in the data. As shown in table 1, all but three items—the availability of alternative buyers for the supplier, supplier's technological advantage over other producers, and supplier's customization of management methods to work effectively with the manufacturer organization—loaded uniquely and unequivocally on one of the factors. Because these three items could not differentiate between our two constructs, we dropped them from consideration in the scale construction.

Items were standardized to eliminate differences in variance due to scaling and averaged to construct the manufacturer's (Cronbach's $\alpha = .61$) and supplier's dependence (Cronbach's $\alpha = .62$) scales.[3] The two scales had a correlation coefficient of .148 ($p < .10$). We constructed the joint dependence variable by adding measures of the manufacturer's and supplier's dependence.[4] The data that we collected for the purposes of measuring dependence represent a combination of perceptual and objective measures; this approach thus alleviates

**2**
We used factor loadings of .300 and higher for classifying items across factors, as they are thought to reflect acceptable levels of correlation between items and latent variables. This is consistent with general guidelines for scale construction (Kim and Mueller, 1978) and prior empirical research (Dess and Beard, 1984). Here and throughout the paper, loadings resulting from the varimax orthogonal rotation procedure were verified using the promax form of oblique rotation (Conway and Huffcutt, 2003). We also met a more holistic standard for adopting a particular factor structure as we (1) had at least three items loading on each factor, (2) eliminated items with high cross-factor loadings, and (3) retained factors with eigenvalues of at least 1.0 (Kim and Mueller, 1978; Zeller and Carmines, 1980).

**3**
Although these reliabilities fall short of the frequently used threshold of .70 (Nunnally, 1978), in more recent research on reliability measures, Pedhazur and Schmelkin (1991) and John and Benet-Martinez, (2000) have explicitly stated that this should not be considered a benchmark every scale has to pass. Contingent on the validity of the construct's conceptualization, reliabilities of as low as .50 can be viewed as acceptable (Pedhazur and Schmelkin, 1991). In addition, according to the classical test theory, losses in reliability of constructs only make it harder to capture significant relationships between constructs (Lord and Novick, 1968; Cohen and Cohen, 1975), hence making our analysis more conservative while leaving the likelihood of our making a type I error intact.

**4**
The additive specification of mutual dependence is directly in line with Emerson's original proposition and our theoretical argument. Further, it was the choice of other research on similar issues (Kumar, Scheer, and Steenkamp, 1995, 1998; Casciaro and Piskorski, 2005). An alternative specification to the additive score is the multiple of two dependencies. Because we focus on ongoing exchange relationships, we have no zero dependence scores and thus run no risk of misrepresenting the mutual dependence score in the instances of no mutual dependence (as in receiving a non-zero sum when one of the dependence scores is zero) (see Casciaro and Piskorski, 2005). More generally, while the additive score may be more accurate than the product score in describing joint dependence in some situations (as in 9–1 vs. 3–3), it could be less accurate in others (as in 1–9 vs. 5–5). We hence verified our results using a product score of joint dependence, and they remained similar.

Table 1

**Common Factor Analysis of Manufacturer and Supplier Dependence Measures***

| Survey item | Factor 1 | Factor 2 |
|---|---|---|
| 1. Manufacturer's switching cost ("It would require much trouble and expense for your firm to switch suppliers for this commodity.") | .207 | **.528** |
| 2. Availability of potential suppliers ("There are enough potential suppliers to ensure adequate competition among the current suppliers" [reverse coded].) | –.265 | **.342** |
| 3. Availability of alternate sources of short-term supply ("There are satisfactory alternate sources of short-term supply available for this commodity" [reverse coded].) | –.124 | **.528** |
| 4. Percentage of manufacturer's component requirements procured from the supplier | .082 | **.398** |
| 5. Supplier has technological advantage over other producers (7-point Likert scale with options ranging from 1 = "Strongly disagree" to 7 = "Strongly agree") | .242 | .278 |
| 6. Supplier has adapted its management methods to work effectively with your organization (7-point Likert scale with options ranging from 1 = "Strongly disagree" to 7 = "Strongly agree") | .126 | .195 |
| 7. Manufacturer has made significant relationship-specific investments (7-point Likert scale with options ranging from 1 ="Strongly disagree" to 7 = "Strongly agree") | .091 | **.366** |
| 8. Percentage of supplier's total sales sold to the manufacturer | **.448** | .070 |
| 9. Number of alternative buyers for supplier† | .120 | .118 |
| 10. Manufacturer's withdrawal cost for supplier ("The supplier would face a serious financial crisis if you withdrew your business from them.") | **.417** | .056 |
| 11. Supplier has made significant relationship-specific investments (7-point Likert scale with options ranging from 1 = "Strongly disagree" to 7 = "Strongly agree") | .168 | **.527** |
| 12. Total dollar volume of the commodity purchased from supplier‡ | **.737** | .002 |
| 13. Total dollar volume of all commodities purchased from supplier | **.619** | .135 |
| Eigenvalue | 1.844 | 1.176 |
| Proportion of variance explained by eigenvector | .475 | . 287 |

* All measures are standardized; varimax orthogonal rotation procedure is used for reported results. Results were verified using a promax version of oblique rotation that presumes non-independence of extracted factors. All items are standardized.

† The measure was inverted to reflect a supplier's dependence.

‡ This and the next dollar measure were measured as a categorical variable comprising 4 categories: up to 10 million (1); 10–50 million (2); 50–100 million (3); more than 100 million (4)

some concerns with regard to having the data collected on one side of the dyad.

*Manufacturer's dependence advantage and supplier's dependence advantage.* We used a spline specification to measure the direction of asymmetry and subsequently differentiate between the manufacturer's and supplier's dependence advantage (Johnston, 1984).[5] It is possible to use a single variable of asymmetry instead of the spline decomposition, but the single variable technique would needlessly constrain one of the dependence advantage variables (other than the one extended into a single variable), eliminating the flexibility and the precision of spline estimation (Kumar, Scheer, and Steenkamp, 1998). Given that we had two distinct categories of actors, we opted for the precision of spline estimation, which allowed us to explore the possible variations in the effects of the manufacturer's and the supplier's dependence advantage that could go beyond the diametrically opposite hypothesized effects and that would not be uncovered in a single variable approach.

To create a measure (spline) of the manufacturer's dependence advantage, we first calculated the values of $(D_S - D_M)$ or the difference between the supplier's and the manufacturer's dependencies on each other. We then recoded this variable to equal $(D_S - D_M)$ if $(D_S > D_M)$ and zero if otherwise. Similarly, to create the measure of supplier's dependence advantage, we calculated $(D_M - D_S)$, keeping the original val-

**5**
Some scholars oppose the use of difference scores, arguing instead for the unconstrained specification of the variables under consideration in the form of polynomial functions (Edwards, 2001, 2002). In our case, however, given the severe simultaneity bias between joint dependence and performance and the subsequent modeling of joint dependence as both a dependent and an independent variable, such polynomial decomposition would have to apply at the level of the predictor and the outcome, the latter of which is unattainable.

ues if ($D_M > D_S$) and letting them equal zero if otherwise. Thus a measure of the supplier's dependence advantage captures the manufacturer's excess (net of the supplier's) dependence on the supplier. In turn, the supplier's excess dependence on the manufacturer is captured by the measure of the manufacturer's dependence advantage. Following this decomposition, our sample returned 72 dyads in which a supplier held a dependence advantage and 79 dyads in which a manufacturer did.

*Performance.* We used twelve survey questions as indicators of a manufacturer's performance in the procurement relationship, which were designed to measure the buyer's satisfaction with the exchange relationship. The measures were carefully identified based on our analysis of the related literature, discussion with industry experts, and pretests. The manufacturers collected rich archival data to measure directly the efficacy of each of procurement relationship for each of its components, which were not available to us because such data were considered sensitive company information. But managers were willing to assess the accuracy of our survey items by comparing our measures against theirs for selected items. As with our measure of dependence, to ensure that our self-reported measures of performance did not suffer from serious perceptual biases, we asked our contacts at each firm to correlate some of them with their objective indicators of the manufacturer's performance for a random subsample of 20 percent of the valid survey responses. This was done for the measures of past target-price ratio, defect rate (inverted), as well as for the change in component price (inverted) and improvement in defect rate taken from the year preceding the survey and adjusted for the comparable measure of the second-best tracked supplier. The obtained correlation coefficients of over .90 attested to the reliability of the survey measures.

As table 2 shows, factor analysis followed by the varimax rotation procedure returned a two-factor solution (Kaiser, 1958), with nine items loading unequivocally on the first factor and two on the second. A detailed analysis of the items that loaded on the second factor revealed that all of them were measuring interorganizational conflict. Because the construct of conflict was beyond the theoretical scope of this paper, we dropped these two items from scale construction. We averaged the first nine items to create a composite measure of performance (Cronbach's $\alpha = .91$).

While the degree of conflict in the relationship can be viewed as an alternative performance measure, we felt it was less appropriate given the focus of this study. First, when investigating performance, much of the extant power and especially embeddedness research focused on the concrete "economic outcomes" rather than on their behavioral proxies. Thus our performance measure is more closely aligned with this tradition of looking at performance. Second, we did not feel that our measure of conflict allowed us to adequately distinguish between functional and dysfunctional conflict, the two critical facets of the conflict construct that are likely to have different levels of covariation with economic performance (Jehn, 1995). Finally, we could only retain two items that unequivo-

Table 2

**Common Factor Analysis Loadings for Performance Construct***

| Survey item | Factor 1 | Factor 2 |
|---|---|---|
| 1. Price competitive | **.572** | –.133 |
| 2. Support and services | **.748** | –.042 |
| 3. Flexibility in production | **.764** | .108 |
| 4. Product quality | **.824** | .148 |
| 5. Product innovations | **.728** | .093 |
| 6. Average past target-price ratio | **.729** | –.017 |
| 7. Average past price-change ratio | **.690** | .016 |
| 8. Average defect rate | **.820** | .168 |
| 9. Improvement in average defect rate | **.822** | .153 |
| 10. Frequency of disagreements (7-point Likert scale with options ranging from 1 "Occur very rarely" to 7 "Occur very frequently") | –.395 | .539 |
| 11. Ease of negotiations when manufacturer requests engineering changes (7-point Likert scale with options ranging from 1 "Very easy" to 7 "Very difficult") | –.244 | **.689** |
| 12. Ease of negotiations when supplier's raw material costs increase (7-point Likert scale with options ranging from 1 "Very easy" to 7 "Very difficult") | –.161 | **.676** |
| Eigenvalue | 5.278 | 1.337 |
| Proportion of variance explained by eigenvector | .731 | .185 |

***** Unless otherwise specified, respondents ranked suppliers compared with the best alternative supplier for this commodity using a 7-point Likert scale with options ranging from 1 = "Much less attractive than alternative" to 7 = "Much more attractive than alternative."

cally loaded onto the conflict factor, which falls short of the recommended three-item scale for constructing a reliable measure (Kim and Mueller, 1978).

*Joint action.* We measured joint action with ten survey items that reflected the degree of the supplier's involvement in various aspects of cooperative exchange, as well as the degree of joint problem solving and the adaptability of partners in the relationship. Because we included some new items measuring joint action that went beyond prior research on this construct (Heide and John, 1990), we conducted an exploratory factor analysis to ensure that all of the selected items were measuring the degree of joint action in the dyad. As shown in table 3, all but three items, which reflected the treatment of problems of joint responsibilities, the degree of joint improvement of operations, and the degree of joint involvement in forecasting commodity requirements, loaded highly and uniquely on the factor. These three items were excluded from the analysis, and the rest were averaged to construct a *Joint action* scale (Cronbach's $\alpha$ = .83).

We measured interorganizational *Trust* with a scale constructed from six items that correspond closely with those used by other scholars investigating interorganizational trust (Zaheer, McEvily, and Perrone, 1998). Principal component analysis used as a data reduction technique (Conway and Huffcutt, 2003) revealed that all items overwhelmingly loaded on a single factor (Cronbach's $\alpha$ = .85), as shown in table 4.

*Scope and quality of information exchange.* The scope and quality of information exchange in the dyadic buyer-supplier exchange relationship were measured using thirteen survey items that reflected the kinds of information exchanged and the level of detail, timeliness, and accuracy that characterized the information exchange. An exploratory factor analysis rendered a clear two-factor solution, as shown in table 5. One

Table 3

**Common Factor Analysis Loadings for Joint Action Construct***

| Survey item | Factor loadings |
|---|---|
| 1. Initial design | **.666** |
| 2. Quality improvement | **.733** |
| 3. Cost control | **.717** |
| 4. Product modification | **.711** |
| 5. Production process | **.518** |
| 6. Sub-sourcing | **.462** |
| 7. Forecasting commodity requirements | .288 |
| 8. Joint improvement of operations ("Your company engages in ongoing discussion with the supplier to jointly improve both their operations and yours.") | .050 |
| 9. Mutual adjustment in the relationship ("Both parties expect to be able to make adjustments in the ongoing relationship to be able to deal with changing circumstances.") | **.314** |
| 10. Treating problems as joint responsibilities ("Problems that arise in the course of the relationship are treated by parties as joint rather than individual responsibilities.") | .214 |
| Eigenvalue | 3.500 |
| Proportion of variance explained by eigenvector | .870 |

***** For items 1–7, the supplier's involvement in the manufacturer's decision making was measured using a 7-point Likert scale with options ranging from 1 = "Not at all involved" to 7 = "Involved to a great extent." Items 8–10 were measured with a 7-point Likert scale with options ranging from 1 = "Strongly disagree" to 7 = "Strongly agree."

Table 4

**Principal Component Analysis Loadings for Trust Construct***

| Survey item | Principal component loadings |
|---|---|
| 1. The supplier has always been even handed in its negotiation with your company. | **.800** |
| 2. This supplier may use opportunities that arise to profit at your expense (reversed). | **.730** |
| 3. Based on past experience, you cannot with complete confidence rely on this supplier to keep promises made to you (reversed). | **.780** |
| 4. You are hesitant to transact with this supplier when specifications are vague (reversed). | **.704** |
| 5. You trust this supplier to treat you fairly. | **.798** |
| 6. You trust that confidential/proprietary information shared with this supplier will be kept strictly confidential. | **.714** |
| Eigenvalue | 3.424 |
| Proportion of variance explained by eigenvector | .571 |

***** All items were measured using a 7-point Likert scale with options ranging from 1 = "Strongly disagree" to 7 = "Strongly agree."

item that reflected the degree of marketing information exchange did not load uniquely on either of the factors and hence was excluded from scale construction. Items that loaded on factor 1 were averaged and used to measure the *Quality of information exchange* as reflected by its level of detail, timeliness, and accuracy (Cronbach's $\alpha$ = .88). Items that loaded on factor 2 were averaged and used to measure *Information exchange scope* as reflected in the frequency of exchanged information of various types (Cronbach's $\alpha$ = .76).

## Control Variables

To ensure the robustness of our results, we included several control variables. We first controlled for the factors associated with the characteristics of the exchanged component, namely, its levels of criticality and standardization. These component dimensions may affect not only the requisite lev-

els of interdependence but also the need for information, trust, and joint action. Given prior research establishing the effects of the duration of a relationship on trust, joint action, information transfer, and performance (Larson, 1992; Uzzi, 1997, 1999; Gulati and Sytch, 2007), we controlled for the various facets of relationship duration: component history, organizational history, as well as the buyer's and supplier's personal histories. In addition, we controlled for the level of multiplexity, i.e., the number of levels at which the organizations are connected, one of the antecedents of embedded relationships (Uzzi, 1999).

We also controlled for assembler-specific effects by including a dummy variable *Firm.* Because of the sensitivity of our assembler-specific effects and issues of confidentiality, we are not able to disclose the identity of our default category choice. We used a *Strategic alliance* variable that distinguishes between external strategic alliances (long-term and open-ended contracts) and market-like arrangements (short-term contracts and competitive bidding) to capture the unique effects of the governance structure of the relationship with the external supplier on the performance of exchanges as well as on the mediating variables. The measures for the control variables are described in table 6.

## Analysis

Our central theoretical argument led us to predict that as levels of joint dependence in a procurement relationship increase, a manufacturer's performance in the relationship will improve. Yet it is also plausible to argue that a manufacturer's satisfaction with the exchange stemming from the superior value creation in the exchange will lead to exchange partners allocating more business to each other, hence increasing levels of joint dependence in the relationship. This potential reciprocally causal relationship resulted in a simultaneous-equation bias in our research design (Greene, 2003). In

Table 5

**Common Factor Analysis Loadings for Information Constructs***

| Survey item | Factor 1 | Factor 2 |
|---|---|---|
| 1. Quality information | .126 | **.423** |
| 2. Inventory information | –.265 | **.401** |
| 3. Schedule and delivery information | –.127 | **.451** |
| 4. Detailed cost information | .178 | **.487** |
| 5. Marketing information | .305 | .364 |
| 6. Long-term volume projections | .001 | **.568** |
| 7. Manufacturing process information | –.101 | **.705** |
| 8. Proprietary technical information | .250 | **.576** |
| 9. Design information | .292 | **.500** |
| 10. Production capacity | .162 | **.648** |
| 11. Accuracy of information received | **.836** | .063 |
| 12. Detail of information received | **.874** | .122 |
| 13. Timeliness of information received | **.755** | –.114 |
| Eigenvalue | 3.117 | 2.094 |
| Proportion of variance explained by eigenvector | .535 | .359 |

***** For items 1–10 the kinds of information exchanged between the manufacturer and the supplier were measured using a 7-point Likert scale with options ranging from 1 = "Not at all exchanged" to 7 = "Exchanged very frequently." For items 11–13, respondents were asked to characterize the information exchange between their organization and supplier on a 7-point Likert scale with options ranging from 1 = "Poor" to 7 = "Excellent."

Table 6

**Descriptions of Control Variables**

| Variable | Measure |
|---|---|
| 1. Component criticality | "Component is critical to the mechanical functioning of the automobile" (7-point Likert scale with options ranging from 1 = "Strongly disagree" to 7 ="Strongly agree"). |
| 2. Component standardization | Ordered categorical measure of the extent of standardization of the component used: in one trim line within a model (1), one model (2), one platform (3), more than one platform (4) or companywide (5). |
| 3. Component history | Logarithm of the number of years assembler has purchased the listed component from the supplier. |
| 4. Organizational history | Logarithm of the number of years assembler has purchased any component from the supplier. |
| 5. Buyer's personal history | Logarithm of the number of months a purchasing agent personally dealt with a supplier. |
| 6. Supplier's personal history | Logarithm of the number of months a supplier representative has been directly involved in dealing with the buyer. |
| 7. Multiplexity | "Manufacturer is extensively tied to the supplier through additional business ties (e.g., shared board members, charity boards, etc.)" (7-point Likert scale with options ranging from 1 = "Strongly disagree" to 7 = "Strongly agree"). |
| 8. Firm | Dummy variable distinguishing between Ford and Chrysler.* |
| 9. Strategic alliance | Ordered categorical measure of the governance mode: external buying arrangement (0); external supplier alliance (1). |
| 10. Component complexity | "Component is very complex in relation to others that go into the vehicle" (7-point Likert scale with options ranging from 1 = "Strongly disagree" to 7 = "Strongly agree").† |
| 11. Streamlined procedures | Ranking of the firm's and the supplier's procedures on a 7-point Likert scale with options ranging from 1 = "Bureaucratic" to 7 = "Streamlined." The responses were summed to reflect the level of streamlined procedures in the dyad. |

* Due to the sensitivity of our assembler-specific effects and issues of confidentiality, we are not able to disclose the identity of our default category choice.
† Items 10 and 11 serve as instrumental variables.

line with the expectations of a simultaneous-equation bias, the Hausman (1978) test did indicate the presence of endogeneity in the joint dependence measure ($p = .078$). A simple ordinary least squares (OLS) estimator is inapplicable for a simultaneity bias because the endogenous variables are correlated with the disturbance term, hence rendering OLS estimates inconsistent. To account for the possible simultaneity between joint dependence and performance, we used a three-stage least squares variation of simultaneous equation modeling (Zellner and Theil, 1962), which allowed us to estimate performance simultaneously as a function of joint dependence and joint dependence as a function of performance. By doing so, we could isolate the effect of dependence on performance while controlling for the possible reverse effects. The estimated system of equations can be formally expressed as follows:

$$\text{Performance} = \text{Joint dependence} + x_1 + x_2 + \ldots + x_k + z_1 + \varepsilon_1$$

$$\text{Joint dependence} = \text{Performance} + x_1 + x_2 + \ldots + x_k + z_2 + \varepsilon_2,$$

where $x_1 \ldots x_k$ are the exogenous controls; $z_1$ and $z_2$ are the instrumental variables for joint dependence and performance, respectively; and $\varepsilon_1$ and $\varepsilon_2$ are the error terms for the performance and joint dependence equations, respectively.

The three-stage estimation procedure involved three steps: First, the instrumented or predicted values of the two endogenous variables in our system (joint dependence and

performance) were generated, using all exogenous variables in the system. Second, using the residuals from the structural equations with instrumented variables (two-stage least squares), a cross-equation covariance matrix of the disturbance terms from the first stage was estimated. In the third step, the equations with the instrumented endogenous variables were stacked together and subjected to the seemingly unrelated estimation algorithm to account for cross-equation covariances (Greene, 2003: 406). The end result of this estimation procedure was the set of unbiased estimates that allowed us to isolate the effect of joint dependence on performance net of the reciprocally causal effect.

We used two instrumental variables to help uniquely identify performance and joint dependence models in the system of simultaneous equations. For the joint dependence model, we used a variable capturing component complexity. We expected levels of component complexity to lead to higher degrees of joint dependence due to the need for superior coordination. To uniquely identify the performance equation, we created a variable that reflects the degree of streamlined procedures in the exchange relationship (see table 6). We expected the measure of streamlined procedures to be positively correlated with the manufacturer's performance. We had no a priori theoretical reasons to expect component complexity to have a direct effect on a manufacturer's performance and streamlined procedures to have a direct effect on the levels of joint dependence.

## RESULTS

Table 7 reports the means, standard deviations, and correlations of the measures. Because we observed some relatively high correlations among the mediating variables as well as between the mediating variables and performance, we addressed possible concerns of multicollinearity in our OLS models by calculating the variance inflation factor values. Calculated for each independent variable in every OLS equation, these values are used to test whether the amount of variance in any given independent variable that is explained by other independent variables is reasonably low. The variance inflation factor values did not exceed 2.5, far below the limit of 10 recommended by Chatterjee and Price (1991). Although we could not calculate the variance inflation factors for 3SLS equations, the relatively low values obtained for OLS models coupled with a negligible trace of $(X'X)^{-1} = .357$ (Mason and Perreault, 1991) assured us that multicollinearity did not pose a serious threat to the power of our analyses.

As explained above, to control for the simultaneity bias resulting from the possible reciprocal causal relationship between joint dependence and performance, we used a three-stage variation of simultaneous equation modeling. The Breusch-Pagan test (Breusch and Pagan, 1979) for heteroskedasticity led us to reject the null hypothesis of homoskedastic error variance at various levels of significance in several of our models. One possible reason for this may be the non-independence of observations, as certain suppliers in our sample supplied more than one component to the same manufacturer. When simple OLS regressions were utilized,

Table 7

**Means, Standard Deviations, and Correlations (N = 151)**

| Variable | Mean | S.D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. Performance | 4.632 | .905 | — | | | | | | | |
| 2. Joint action | 4.770 | .989 | .411 | — | | | | | | |
| 3. Trust | 4.907 | 1.005 | .528 | .327 | — | | | | | |
| 4. Information quality | 4.945 | 1.139 | .597 | .456 | .587 | — | | | | |
| 5. Information scope | 5.119 | .750 | .182 | .485 | .075 | .148 | — | | | |
| 6. Joint dependence | –.112 | .911 | .294 | .284 | .127 | .248 | .159 | — | | |
| 7. Manufacturer's dependence advantage | .341 | .497 | –.177 | –.045 | .039 | –.160 | –.113 | .071 | — | |
| 8. Supplier's dependence advantage | .283 | .427 | .088 | –.107 | –.048 | .036 | .061 | –.234 | –.459 | — |
| 9. Complexity | 4.616 | 1.673 | .239 | .117 | .071 | .144 | .093 | .422 | –.106 | .020 |
| 10. Streamlined procedures | 7.278 | 2.341 | .375 | .271 | .380 | .347 | .180 | .098 | .117 | –.098 |
| 11. Criticality | 4.861 | 1.953 | .058 | .061 | .216 | .148 | .170 | .158 | –.182 | .086 |
| 12. Standardization | 3.536 | 1.412 | .024 | .009 | –.127 | .032 | .256 | .001 | –.045 | –.002 |
| 13. Component history | 2.409 | .754 | –.093 | –.004 | –.159 | –.154 | –.001 | –.020 | .236 | –.085 |
| 14. Organizational history | 2.815 | .731 | –.122 | .036 | –.084 | –.130 | .006 | .100 | .191 | –.015 |
| 15. Buyer personal history | 3.107 | .832 | .152 | .062 | –.138 | –.019 | .089 | .127 | –.057 | –.037 |
| 16. Supplier personal history | 3.593 | .814 | .002 | –.072 | –.084 | –.057 | .059 | –.039 | –.040 | –.008 |
| 17. Multiplexity | 3.252 | 1.528 | .195 | .126 | –.035 | .078 | .098 | .241 | –.075 | –.150 |
| 18. Firm | .497 | .502 | .062 | .337 | .037 | .192 | .308 | .061 | –.232 | .064 |
| 19. Strategic alliance | .642 | .481 | .021 | –.074 | .025 | .008 | –.159 | .075 | .102 | –.049 |

| Variable | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|
| 9. Complexity | — | | | | | | | | | |
| 10. Streamlined procedures | –.102 | — | | | | | | | | |
| 11. Criticality | .304 | –.115 | — | | | | | | | |
| 12. Standardization | .136 | .055 | .129 | — | | | | | | |
| 13. Component history | –.103 | –.136 | –.042 | .006 | — | | | | | |
| 14. Organizational history | .084 | –.175 | .130 | .022 | .681 | — | | | | |
| 15. Buyer personal history | .179 | –.085 | –.100 | .169 | .212 | .121 | — | | | |
| 16. Supplier personal history | –.064 | –.015 | .009 | .074 | .175 | .009 | .172 | — | | |
| 17. Multiplexity | .236 | .070 | –.002 | –.078 | .063 | .061 | .066 | –.076 | — | |
| 18. Firm | .046 | .148 | .023 | .308 | –.098 | .053 | .278 | –.101 | .001 | — |
| 19. Strategic alliance | .052 | –.177 | –.195 | –.157 | .136 | .092 | .054 | –.043 | .105 | –.033 |

we used a clustering option for suppliers, assuming that the distribution of $(x_i, e_i)$ is not independent and reporting a set of standard error estimates robust to the deviation from the standard assumption of homoskedasticity (Rogers, 1993).

Similar to OLS, heteroskedasticity poses a problem in 3SLS estimation because it can bias the standard errors of the estimated coefficients. Because the direct adjustment of standard errors is not available in 3SLS Stata estimation, we used a nonparametric bootstrap method to extract the bias-corrected coefficient estimates and standard errors (Efron, 1981, 1982). At the heart of this procedure is drawing independent repeated random samples with replacement from the existing sample in which the statistics of interest (coefficients and standard errors) are calculated for each sample. The bootstrap estimates are based on the generated sampling distributions. In implementing the bootstrap, we made provisions for the clustered structure of our data, subsequently setting the size of repeated random samples equal to the number of clusters. Because in this specification the sampling is done by clusters, the number of observations in each random sample varies depending on which clusters are selected. Our estimates are based on 1,000 random samples (Efron and Tibshirani, 1985). Results remained qualitatively unchanged.

Table 8 contains the results of simultaneous equation estimation, where performance and joint dependence are estimated

Table 8

**Simultaneous Equation Estimations Using Three-Stage Least Squares Regressions (N = 151)***

| Performance model | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 |
|---|---|---|---|---|---|
| Constant | 2.480$^{\bullet\bullet\bullet\bullet}$ | 3.350$^{\bullet\bullet\bullet\bullet}$ | 2.166$^{\bullet\bullet\bullet}$ | 1.997$^{\bullet\bullet\bullet}$ | 1.484$^{\bullet}$ |
| | (.620) | (.691) | (.823) | (.767) | (.791) |
| Criticality | .074$^{\bullet\bullet}$ | .013 | .011 | –.015 | –.012 |
| | (.036) | (.041) | (.038) | (.035) | (.034) |
| Standardization | –.005 | .010 | .031 | .015 | .028 |
| | (.059) | (.049) | (.046) | (.043) | (.042) |
| Component history | –.066 | .091 | .034 | .064 | .036 |
| | (.138) | (.137) | (.131) | (.119) | (.119) |
| Organizational history | –.095 | –.184 | –.168 | –.116 | –.116 |
| | (.137) | (.138) | (.130) | (.122) | (.119) |
| Buyer personal history | .249$^{\bullet\bullet\bullet}$ | .151 | .169$^{\bullet}$ | .170$^{\bullet\bullet}$ | .178$^{\bullet\bullet}$ |
| | (.076) | (.095) | (.090) | (.083) | (.081) |
| Supplier personal history | –.014 | –.021 | –.008 | –.005 | –.0004 |
| | (.075) | (.083) | (.077) | (.072) | (.070) |
| Multiplexity | .087$^{\bullet}$ | .011 | .011 | .022 | .020 |
| | (.050) | (.050) | (.046) | (.043) | (.042) |
| Firm | –.113 | –.192 | –.369$^{\bullet\bullet}$ | –.267$^{\bullet\bullet}$ | –.366$^{\bullet\bullet\bullet}$ |
| | (.165) | (.150) | (.151) | (.131) | (.136) |
| Strategic alliance | .203 | .132 | .170 | .044 | .083 |
| | (.163) | (.148) | (.141) | (.126) | (.126) |
| Streamlined procedures | .159$^{\bullet\bullet\bullet\bullet}$ | .161$^{\bullet\bullet\bullet\bullet}$ | .128$^{\bullet\bullet\bullet\bullet}$ | .095$^{\bullet\bullet\bullet\bullet}$ | .086$^{\bullet\bullet\bullet\bullet}$ |
| | (.032) | (.032) | (.027) | (.025) | (.024) |
| Mfr. dependence advant. | | –.295$^{\bullet\bullet}$ | –.239$^{\bullet}$ | –.163 | –.160 |
| | | (.147) | (.130) | (.124) | (.120) |
| Supplier dependence advant. | | .210 | .208 | .154 | .180 |
| | | (.184) | (.163) | (.159) | (.151) |
| Joint dependence | | .570$^{\bullet\bullet}$ | .452$^{\bullet\bullet}$ | .420$^{\bullet\bullet}$ | .374$^{\bullet}$ |
| | | (.223) | (.225) | (.206) | (.209) |
| Joint action | | | .289$^{\bullet\bullet\bullet\bullet}$ | | .171$^{\bullet\bullet}$ |
| | | | (.077) | | (.067) |
| Quality of information exchange | | | | .347$^{\bullet\bullet\bullet\bullet}$ | .292$^{\bullet\bullet\bullet\bullet}$ |
| | | | | (.062) | (.057) |
| Mediation path | | | .080$^{\bullet\bullet}$ | .092$^{\bullet\bullet\bullet}$ | |
| | | | (.035) | (.035) | |
| Breusch-Pagan test *p*-values (Null: homoskedasticity) | .684 | .761 | .254 | .047 | .092 |
| R-squared | .239 | .229 | .333 | .424 | .456 |
| Chi-squared | 4.88$^{\bullet\bullet\bullet\bullet}$ | 66.21$^{\bullet\bullet\bullet\bullet}$ | 101.59$^{\bullet\bullet\bullet\bullet}$ | 137.92$^{\bullet\bullet\bullet\bullet}$ | 153.84$^{\bullet\bullet\bullet\bullet}$ |
| F-statistic in model 1 | (10,112) | | | | |
| **Joint dependence model** | | | | | |
| Constant | | –2.257$^{\bullet\bullet\bullet}$ | –2.788$^{\bullet\bullet\bullet\bullet}$ | –2.671$^{\bullet\bullet\bullet\bullet}$ | –2.801$^{\bullet\bullet\bullet\bullet}$ |
| | | (.800) | (.711) | (.684) | (.657) |
| Criticality | | .025 | .022 | .023 | .022 |
| | | (.037) | (.037) | (.037) | (.037) |
| Standardization | | –.036 | –.034 | –.034 | –.034 |
| | | (.050) | (.050) | (.050) | (.050) |
| Component history | | –.080 | –.083 | –.082 | –.083 |
| | | (.130) | (.131) | (.130) | (.131) |
| Organizational history | | .139 | .169 | .162 | .170 |
| | | (.134) | (.132) | (.131) | (.131) |
| Buyer personal history | | .048 | .030 | .034 | .029 |
| | | (.091) | (.091) | (.090) | (.090) |
| Supplier personal history | | .003 | .002 | .002 | .002 |
| | | (.084) | (.084) | (.084) | (.084) |
| Multiplexity | | .073 | .061 | .064 | .061 |
| | | (.046) | (.046) | (.045) | (.045) |
| Firm | | .055 | .046 | .048 | .046 |
| | | (.146) | (.146) | (.146) | (.146) |

*(Continued on next page)*

Table 8 *(Continued)*

| Joint dependence model | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 |
|---|---|---|---|---|---|
| Strategic alliance | | .080 | .077 | .078 | .077 |
| | | (.141) | (.141) | (.141) | (.141) |
| Complexity | | .176$^{\bullet\bullet\bullet\bullet}$ | .162$^{\bullet\bullet\bullet}$ | .165$^{\bullet\bullet\bullet\bullet}$ | .162$^{\bullet\bullet\bullet\bullet}$ |
| | | (.048) | (.047) | (.046) | (.046) |
| Performance | | .144 | .279$^{\bullet\bullet}$ | .249$^{\bullet\bullet}$ | .283$^{\bullet\bullet}$ |
| | | (.162) | (.132) | (.121) | (.112) |
| Breusch-Pagan test *p*-values (Null: homoskedasticity) | | .486 | .512 | .510 | .513 |
| R-squared | | .246 | .242 | .246 | .242 |
| Chi-squared | | 43.73$^{\bullet\bullet\bullet\bullet}$ | 47.22$^{\bullet\bullet\bullet\bullet}$ | 47.56$^{\bullet\bullet\bullet\bullet}$ | 49.04$^{\bullet\bullet\bullet\bullet}$ |

$^{\bullet}$ $p < .10$; $^{\bullet\bullet}$ $p < .05$; $^{\bullet\bullet\bullet}$ $p < .01$; $^{\bullet\bullet\bullet\bullet}$ $p < .001$; two tailed tests.
***** Standard errors in parentheses. Model 1 is estimated using simple OLS, with robust standard errors adjusted for non-independence of observations. The number of clusters = 113.

as mutually influencing each other. The table reports systems of equations, where each system comprises two equations or models that are estimated simultaneously: the first one reflects performance as a function of joint dependence and various exogenous predictors, and the second one estimates joint dependence as a function of performance along with the set of exogenous variables. Model 1 in table 8 represents an exception, since we used a simple OLS model with robust standard errors to test the baseline performance model by regressing performance on the set of control variables. The simultaneity bias is not an issue here because the measure of joint dependence is excluded from the model. Among the control variables, component criticality, buyer personal history, multiplexity, and streamlined procedures are significant and positively affect a manufacturer's performance. With the exception of buyer personal history and the streamlined procedures variables, the latter of which was subsequently used as an instrument in the performance equation in three-stage least squares models, the effects of control variables appeared to be unstable and disappeared once the variables of theoretical interest were introduced.

We used a set of simultaneous equation systems estimated with the three-stage least squares estimator to test hypotheses 2–5.[6] Beginning with model 2 in table 8, we introduce another exogenous variable in the system to instrument the joint dependence equation: component complexity. Component complexity has a strong positive effect on joint dependence, indicating that exchange partners tend to prefer more exclusive relationships for components entailing high levels of complexity. It is essential to note that both of our instruments (streamlined procedures and component complexity) remain significant across all model specifications, which is a first essential requirement of instrumental variables and ensures that our system of equations remains identified at all times. We further empirically verified that our instruments met the second condition of instrumental variables and had no partial direct effect on their non-respective endogenous variables: thus, controlling for other variables in the system, streamlined procedures had no direct effect on joint dependence, and component complexity had no direct effect on

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Although 3SLS is generally preferred to 2SLS for reasons of efficiency, we verified our 3SLS results using a 2SLS estimator. Results remained similar.

performance (Wooldridge, 2002: 83–84). Meeting these conditions makes us reasonably certain that we effectively dealt with endogeneity in joint dependence and performance emanating from the simultaneity bias between them as well as from other possible sources, such as the omitted variable bias and measurement error. Because our system is just identified (we have equal numbers of endogenous variables and instruments), we could not formally check for the absence of correlation between the instrumental variables and the structural errors by testing for overidentifying restrictions (Hausman, 1978).

To test hypotheses 1a, 1b, and 2, we included the variables of manufacturer's dependence advantage, supplier's dependence advantage, and joint dependence in the performance equation in model 2 of table 8. Hypothesis 1a predicted that a manufacturer's dependence advantage would enhance performance, while hypothesis 1b postulated that a supplier's dependence advantage would diminish performance. Contrary to our expectations, a manufacturer's dependence advantage has a significant negative effect on performance, while the effect of supplier's dependence advantage is not significantly different from zero. Hence, hypotheses 1a and 1b are not supported. Hypothesis 2 predicted that joint dependence would be positively related to performance. Consistent with our prediction, joint dependence has a significant positive effect on performance, supporting hypothesis 2. We also tested for a possible curvilinear relationship but found no evidence of it.

To test hypotheses 3–5, we followed the rules for mediation testing suggested by Baron and Kenny (1986). The first step in testing for mediation requires us to establish a significant relationship between the independent variable and the dependent variable. While recent research on mediation testing (e.g., MacKinnon et al., 2002; Shrout and Bolger, 2002) suggests that this step is not required, as it represents an unnecessarily strong restriction in testing for mediation, we elected to incorporate it into our method because we predicted an analytically proximate relationship between the independent variable and the dependent variable, i.e., joint dependence and performance. Because in our model this step required establishing a significant relationship between joint dependence and performance, this requirement was fulfilled with the support for hypothesis 2.

The second step mandates that the significant relationship between the independent variable and the mediator be established. Table 9 reports the results of OLS regressions analyzing the relationship between joint dependence and the proposed mediators. Significant relationships were established for joint action and the quality of information exchange, but no significant relationships were found for trust and the scope of information exchange, thus refuting hypothesis 4 and the part of hypothesis 5 that focused on the mediating effect of the scope of information exchange.

In the final step of testing for mediation, the dependent variable was regressed on the independent variable and the mediator in models 3–5 in table 8. Hypothesis 3 predicted

Table 9

**Regressions Establishing a Relationship between Joint Dependence and the Mediating Variables of Joint Action, Trust, Information Exchange Scope and Quality (N = 151)***

| Variable | Model 1 Joint action | Model 2 Trust | Model 3 Scope of information exchange | Model 4 Quality of information exchange |
|---|---|---|---|---|
| Constant | 5.011$^{\bullet\bullet\bullet\bullet}$ | 5.618$^{\bullet\bullet\bullet\bullet}$ | 4.248$^{\bullet\bullet\bullet\bullet}$ | 5.499$^{\bullet\bullet\bullet\bullet}$ |
| | (.523) | (.514) | (.410) | (.661) |
| Criticality | .008 | .130$^{\bullet\bullet\bullet}$ | .042 | .067 |
| | (.046) | (.046) | (.030) | (.053) |
| Standardization | –.078 | –.120 | .079$^{\bullet}$ | –.016 |
| | (.057) | (.075) | (.040) | (.068) |
| Component history | .155 | –.114 | .122 | .050 |
| | (.141) | (.136) | (.137) | (.148) |
| Organizational history | –.100 | –.113 | –.123 | –.285$^{\bullet}$ |
| | (.142) | (.139) | (.150) | (.148) |
| Buyer personal history | –.083 | –.113 | –.039 | –.107 |
| | (.087) | (.100) | (.066) | (.125) |
| Supplier personal history | –.030 | –.029 | .068 | –.024 |
| | (.088) | (.110) | (.062) | (.117) |
| Multiplexity | .036 | –.038 | .055 | .019 |
| | (.059) | (.058) | (.053) | (.069) |
| Firm | .762$^{\bullet\bullet\bullet\bullet}$ | .251 | .426$^{\bullet\bullet\bullet}$ | .441$^{\bullet}$ |
| | (.178) | (.214) | (.131) | (.233) |
| Strategic alliance | –.225 | .130 | –.198 | .089 |
| | (.155) | (.166) | (.140) | (.223) |
| Mfr. dependence advant. | –.021 | .218 | .047 | –.171 |
| | (.187) | (.203) | (.160) | (.252) |
| Supplier dependence advant. | –.161 | –.059 | .178 | .109 |
| | (.219) | (.224) | (.163) | (.262) |
| Joint dependence | .276$^{\bullet\bullet\bullet}$ | .102 | .124 | .314$^{\bullet\bullet\bullet}$ |
| | (.092) | (.106) | (.084) | (.100) |
| Breusch-Pagan test *p*-values (Null: homoskedasticity) | 0.189 | 0.054 | 0.001 | 0.411 |
| R-squared | .220 | .137 | .202 | .153 |
| F (12, 112) | 4.11$^{\bullet\bullet\bullet\bullet}$ | 2.20$^{\bullet\bullet}$ | 4.22$^{\bullet\bullet\bullet\bullet}$ | 2.45$^{\bullet\bullet\bullet}$ |

$^{\bullet}$ $p < .10$; $^{\bullet\bullet}$ $p < .05$; $^{\bullet\bullet\bullet}$ $p < .01$; $^{\bullet\bullet\bullet\bullet}$ $p < .001$; two tailed tests.

***** Robust standard errors, adjusted for non-independence of observations, are in parentheses. The number of clusters = 113.

that joint action would partially mediate the effects of joint dependence on performance. Joint action has a significant positive effect on performance in model 4 in table 8, which leads to a substantial improvement of the overall fit of the model, as indicated by noticeable positive changes in the values of the chi-squared and R-squared statistics. More important, based on Baron and Kenny's (1986) more stringent specification of Sobel's (1982) test for the significance of mediation, the partial mediating effect of joint action is significant, as indicated by the mediation path coefficient in table 8.

As predicted by the part of hypothesis 5 that focused on implications of the quality of information exchange, this factor has a significant positive effect on performance and, like joint action, partially mediates the effects of joint dependence. The mediating effect of the quality of information exchange is significant. Model 4 in table 8, which incorporated the quality of information exchange, produced a better overall fit than the model that included joint action instead. Given that no mediation was established for the scope of

information exchange, hypothesis 5 received only partial support.

A result that emerges from model 3 in table 8 and remains consistent across other model specifications is that performance has a demonstrably strong effect on the level of joint dependence, supporting the intuition that in better performing exchange relationships, partners are more likely to increase their levels of joint dependence. Our results thus demonstrate that the suspected recursive relationship indeed exists, with joint dependence and performance positively and significantly influencing each other. Our primary results remain valid, however, as we controlled for this recursive relationship in our estimations of the antecedents of performance.

In model 5 in table 8, we regressed performance on both mediators along with joint dependence. All mediators are significant, while the regression coefficient for joint dependence decreases in magnitude and remains significant, albeit at a borderline level of significance, indicating nearly full mediation.[7]

Our results indicate, first, that while a manufacturer's dependence advantage has a negative effect on its performance in a procurement relationship, a supplier's dependence advantage has a null effect. Given that these results run counter to our predictions, we explore them further in the discussion section. Second, consistent with our predictions, joint dependence enhances a manufacturer's performance. Moreover, the relationship between joint dependence and performance appears to be reciprocal, wherein the two constructs positively and significantly affect each other. Third, joint action and the quality of information exchange each partially mediated the relationship between joint dependence and a manufacturer's performance, while trust and the scope of information exchange performed no mediating function. Lastly, joint action and the quality of the information exchange each explained some unique variance in a manufacturer's performance unaccounted for by other mediators and together came close to fully mediating the effect of joint dependence on performance.

## DISCUSSION

In taking a closer look at interdependence, this paper has demonstrated that this facet of economic life is largely responsible for the success of economic exchanges. One of our key finding is that interdependence should be viewed as including two distinct dimensions that we call joint dependence and dependence asymmetry. While the effects of dependence asymmetry and actors' concomitant dependence advantages are best understood through a logic of power, joint dependence leads us to think more carefully about the logic of embeddedness that also underlies the actions and motivations of interdependent actors. Using detailed empirical data on procurement relationships of U.S. automotive manufacturers, we have demonstrated that for a manufacturer, joint dependence with its supplier enhances the manufacturer's performance in that procurement relationship. Consistent with this argument, we found that the logic

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In each of the mediation models (models 3, 4, and 5 in table 9), we conducted a robustness check to account for the possibility of partial or full reverse mediation, wherein the effect of performance on joint dependence would be mediated by joint action and the quality of information exchange. Although the quality of information exchange had no reverse mediation effect, we found some evidence that joint action served as a mediator in both directions. At no time during these tests, however, did we observe any changes in the directionality or significance of coefficients in the performance models.

of embeddedness associated with joint dependence confers a number of unique advantages on dyadic exchanges that manifest themselves in increased levels of joint action and superior information exchange, all of which in turn have a positive impact on actors' performance in those exchange relationships.

From a manufacturer's vantage point, we predicted that its power advantage in a procurement relationship would enhance its performance in that relationship, while a supplier's dependence advantage would have the reverse affect. These predictions were driven by the logic of value appropriation, wherein the stronger actors get a bigger share of the pie at the expense of the weaker ones. Our results indicate, in contrast, that a manufacturer's dependence advantage diminished its performance in a procurement relationship and that a supplier's dependence advantage had no effect on the manufacturer's performance. We believe it is worthwhile to revisit these results by reassessing the two key underlying assumptions of our discussion of dependence asymmetry and value appropriation: that the use of power is unequivocally beneficial for the stronger actor and that power imbalance automatically translates into the use of power and coercion.

The first assumption suggests that stronger actors are likely to benefit from their position of power by coercing their exchange partners into an asymmetric distribution of value. This line of reasoning is very clear and intuitively appealing, but it leaves out the possible effect of the use of power and coercion on the total value generated in the relationship. Use of coercion can inflict irrevocable damage on the cooperative spirit of the relationship, diminishing its value-generating potential (Deutsch, 1973; Piskorski and Casciaro, 2006). The expectation of such damage even led some theorists to argue that coercive power is most effective when not used (Morgan, 1977). The qualitative accounts we reviewed above, however, show how keen automotive manufacturers usually are to capitalize on their power advantage and squeeze more dependent suppliers. Our fieldwork observations also attest to this trend: we found that suppliers' dependence generated a sense of entitlement on the part of the manufacturers. There is also little doubt that manufacturers are able to squeeze dependence-disadvantaged suppliers and force them into a disproportionate distribution of value. Considering the dual effect of coercion on increasing value appropriation and decreasing value creation, however, it is possible that the damage to the value-generating potential in the relationship and its cooperative atmosphere may be offsetting the appropriation gains extracted through coercion. In instances of power use, it is reasonable to expect increased avoidance, feelings of anger, and disappointment on the part of the supplier; this, in turn, endangers the value-generating potential of the relationship. In other words, while automotive manufacturers may be getting the bigger share of the pie through coercion, the size of the pie can diminish at a faster rate, leaving them with a net loss. This is in line with our finding of a negative effect of a manufacturer's dependence advantage on its performance in exchange relationships. Our fieldwork seems to echo this, as one of the managers we interviewed

commented, "The thinking used to be here that we'd like to see a supplier totally dependent on us and then we'd have the thumb over them. Now we recognize that neither extreme is good." Another echoed this idea: "I have found that bullying the supplier does not pay in the long run." This finding recalls our central argument about the importance of considering not just value-appropriation but also value-creation dynamics in exchange relationships.

Another interesting finding is the null effect of the supplier's power. Conventional power-dependence reasoning suggests that power asymmetries translate directly into the use of power (Emerson, 1972a, 1972b). Some of the subsequent theorizing, however, has suggested that this relationship can be less unequivocal. For instance, Molm (1981) found that power asymmetry at most explained 28 percent of the variation in the use of power. We believe our unique context, in which relatively small suppliers have to face gigantic automotive manufacturers, makes the relationship between dependence asymmetry favoring the supplier and the supplier's use of power even less straightforward. It appears that suppliers simply tend not to capitalize on their structural power advantage. Our discussions with automotive industry experts indicate that suppliers often have neither the desire nor the resources to convert their structural power advantage into coercion against manufacturers. On the one hand, they are intimidated by the overall stature of their partners as well as the power that manufacturers may exercise in their other relationships. "If the supplier tries to play games with us on [the target goal], we catch on real quick and so most of them don't even dare to try this with us," indicated one of the manufacturer's purchasing agents. On the other hand, reinforcing the claim that influence does come at a cost (Jacobs, 1974), these usually small supplier organizations have limited financial and managerial resources—such as capital and managerial attention—which are often needed to exercise influence. Further attesting to this, the qualitative accounts of the automotive industry that we reviewed above provide no discussion of suppliers cashing in on their structural power advantage. In other words, although suppliers often find themselves in the possession of power, they, unlike manufacturers, often don't use it, leaving the distribution of value intact. This is in line with the null effect of a supplier's dependence advantage on a manufacturer's performance.

An important finding in this paper is that while dependence asymmetries can be best understood through the logic of power, joint dependence makes us think in terms of the logic of embeddedness. Given the extensive focus of the existing power research on dependence asymmetries, we singled out the dimension of joint dependence, suggesting that it enhances actors' performance in the relationship by increasing the overall robustness of the exchange. This is an important distinction from the logic of power, which is exclusively focused on value distribution and appropriation dynamics. By bringing joint dependence to the forefront of understanding firms' performance in procurement relationships, we extend the growing body of work on this important but underexplored dimension of dependence to a new domain of pro-

curement relationships and explicitly link it to the efficacy of those ties. We further try to unpack its underlying logic of relational embeddedness into its three component elements of joint action, trust, and scope and quality of information exchange. We explicated how the relationship between joint dependence and manufacturer's performance is guided by each of these facets of the logic of embeddedness. Our results in this regard are not entirely what we expected. We found that this relationship is partially mediated by the degree of joint action and the quality of information exchange, which highlights the mechanisms through which the logic of embeddedness operates at the level of joint dependence, but not by other factors that have been suggested in prior research. The partial channeling of this effect through these relationship-based covariates of embeddedness suggests that actors' joint dependence—at least partially—contributes to the enhanced performance of the relationship as a whole and its increased value-generating potential.

In assessing the mediating mechanisms that underlie the logic of embeddedness, however, we did not find the scope of information exchange and trust to be related to the level of joint dependence. With respect to scope, perhaps the proximate search effect that we hypothesized as the primary reason for the increased scope of information exchange in mutually dependent relationships is inhibited by the very narrow functional focus of most of the relationships analyzed in this study. The majority of suppliers in our sample specialized in providing just one component, and they may not offer additional exchange benefits to their manufacturer partners. The lack of an effect of joint dependence on trust also merits further consideration in future research. One possible explanation is that relational embeddedness should be analyzed more closely as a multifaceted construct: because it emanates from a variety of distinct antecedents (history of interaction, joint dependence, and shared affiliation, among others), its elements can perform differential mediatory functions depending on embeddedness's precise antecedent structure. Thus, for instance, while joint action and the quality of information exchange can be closely associated with joint dependence, trust can be tightly linked with the partner's history of interaction (e.g., Gulati and Sytch, 2007).

We also explored the possibility that only a moderate degree of joint dependence would bring the greatest benefit to exchange relationships and actors' performance in it; this might be true, for example, if very high levels of joint dependence may become a source of constraint rather than a source of opportunity for exchange partners. Existing research has acknowledged that extreme levels of dependence and the resulting over-embeddedness can limit partners' learning and innovative potential (Uzzi, 1996), restrict valuable feedback (Mizruchi and Stearns, 2001), escalate conflicts to a highly destructive level (Uzzi, 1997), and otherwise create lock-ins in dysfunctional ties (Gargiulo and Benassi, 1999). To explore the likely detrimental effects of joint dependence, we tested for possible curvilinearity in the effects of joint dependence on performance but found no evidence to support this. We believe that this result could be because our

sample represents low levels of joint dependence at which the detrimental effects of embeddedness are not yet that salient. Evidence from prior studies suggests that Korean and Japanese manufacturer-supplier ties are characterized by significantly higher levels of joint dependence than their American counterparts, and even at those levels of dependence, there is still sparse evidence on the downside of such lock-ins (Dyer, Cho, and Chu, 1998). This further suggests that our sampling on the low end of dependence could prevent us from observing deleterious effects that are likely to manifest themselves at extreme levels of relational embeddedness. Thus, though there are sound theoretical reasons to expect extreme levels of joint dependence to decrease actors' performance, we believe that the peculiarities of our empirical context prevented us from establishing this effect empirically.

A final issue is the role of transaction-specific investments with respect to our measure of joint dependence. Our results indicated that both the manufacturer's and the supplier's relationship-specific investments loaded on the manufacturer's dependence factor. These results may appear to run contrary to a conventional application of the transaction costs economics perspective that suggests that highly specific investments by actors actually represent their own dependence, because such investments can be redeployed only with some sacrifice of their productive value, but several factors may help in resolving this paradox. First, our survey item for this measure contained no mention of a high redeployment cost for the investment should it be used outside of the focal relationship. Thus it cannot be regarded as a precise measure of non-redeployable investments, which is the premise of transaction cost economics. Rather, we believe that our items measuring the magnitude of switching costs reflect the potential losses for having to redeploy highly specific assets outside the focal relationship. Second, relationship-specific investments are likely to generate a meaningful flow of benefits for the recipients of such investments, thereby making them highly dependent on such investments (e.g., Williamson, 1981: 555). Our data indicate that the manufacturers may be more dependent on the flow of benefits generated by the suppliers' relationship-specific investments than are the suppliers because these investments are non-redeployable. Further, in today's unstable environments, getting suppliers—which are on average more economically vulnerable than the manufacturing powerhouses under investigation here—to make such relationship-specific investments may be increasingly difficult; this circumstance further supports the argument that manufacturers become increasingly dependent on their suppliers' relationship-specific investments. This hypothesis suggests a direction for future research that would investigate just how relationship-specific investments translate into organizational dependence. Such an investigation would require dropping the currently held assumption that highly specific investments represent a source of dependence exclusively for the investor and looking instead at relationship-specific investments in terms of the relative cost-benefit analysis for both partners.

**Dependence Asymmetry and Joint Dependence**

Our findings established a positive relationship between joint dependence and performance, and one facet of joint dependence in our operationalization is the extent of transaction-specific investments made by the partners. Some scholars have suggested an independent positive direct effect of relationship-specific investments on performance due to more efficient economics of production (Williamson, 1985). To rule out this alternative explanation of the significant positive relationship between joint dependence and performance, we ran additional analyses in which relationship-specific investments were excluded from the joint dependence measure but incorporated in the analysis as a control variable. No substantive changes were observed: relationship-specific investments had no significant effect on either performance or the three mediators of trust, joint action, and quality of information exchange.

Our study makes several contributions to organization science. First, we contribute to social exchange theory (e.g., Emerson, 1962, 1976; Blau, 1964) by shedding light on the role of interdependence as well as on the role of germane relational and behavioral mechanisms in economic exchanges. We unpack the two key facets of interdependence and examine in detail the alternative logics of action that underlie each of them. Our central contribution lies both in introducing and demonstrating the impact of joint dependence and in illuminating the black box of the relationship between joint dependence and a firm's performance in exchange relationships through an empirical examination of the role of several mediating mechanisms in embeddedness. Second, we add to studies of interorganizational relations (e.g., Zeitz, 1980; Galaskiewicz, 1985; Ring and Van de Ven, 1994) and relational embeddedness (Granovetter, 1992; Uzzi, 1997) by showing how joint dependence becomes coupled with the logic of embeddedness to guide firms' performance in exchange relationships. One critical implication of this contribution lies in the need to give heightened attention not just to value-appropriation dynamics stemming from dependence asymmetries but also to overall value creation in exchange relationships driven by joint dependence. Third, we contribute to studies of power and dependence asymmetries in interorganizational relationships by showing that the effects of power use and coercion have to be considered simultaneously for the relative value appropriated in exchanges and the overall value they generate. We also provide additional credit to the ideas that the relationship between dependence asymmetry and power use could be less straightforward than some of the classical power theorizing has assumed and could have important contextual boundary conditions. Finally, we contribute to research in organizational sociology (Thompson, 1967) and related streams in the resource-dependence theory (Pfeffer and Salancik, 1978) that has highlighted the benefits of avoiding dependence and managing the uncertainty it generates by establishing formal governance control mechanisms. Our findings indicate that relational embeddedness and the concomitant social governance mechanisms stemming from joint dependence can be equally effective in resolving uncertainty and enhancing firms' performance.

## Future Research

A number of directions for future research follow from our study. Given that our data were collected on only one side of the dyadic relationship, a more complete picture of interdependence and its consequences would be created if data from both sides of the dyad were collected. This does pose significant logistical challenges, but the payoffs for someone who can overcome them would be huge. More important, a longitudinal setting would enable scholars to explore actors' response over time to relational dynamics triggered by dependence asymmetry and joint dependence. Another direction for future research emerges from our finding of partial mediation of the effect of joint dependence on performance, which suggests that there could be other logics operating there as well. Future research could profitably investigate how the logic of embeddedness may operate side by side with bilateral deterrence (Lawler, Ford, and Blegen, 1988) and the dynamics of mutual hostages (Klein, 1980; Williamson, 1983).

As mentioned before, our analysis was conducted in a setting of sequential interdependence. While the sequential interdependence observed in this study is rather complex, we recognize that there are even more demanding forms of interdependence, such as reciprocal interdependence, which occurs when organizations exchange resources simultaneously and each member's outputs serve as inputs for the other (Thompson, 1967). It is possible that the serious coordination problems posed by this extreme form of interdependence would generate an insurmountable cost burden, thereby altering the observed positive relationship between joint dependence and actors' performance. Similarly, relationships of low levels of task complexity may require lower levels of interdependence, hence decreasing the impact of joint dependence on the performance of those ties. Given that these aspects of the task and interdependence environment could represent important boundary conditions, future research could test our theoretical framework in other task and interdependence settings and explore its possible contingent nature.

Finally, it is important to consider moving beyond the current predominantly dyadic view of interdependence and its implications to a network or system level of analysis (Brass, 1984; Astley and Zajac, 1990). One provocative proposition stemming from this line of reasoning that should be explored in future research—if our distinction in joint dependence is applied to highly integrated systems—is that in a focal relationship an actor may derive its power from increased levels of joint dependence with other actors in the system. The key idea here is that as the actor maximizes its levels of joint dependence with other actors in the system, it simultaneously increases its functional irreplaceability for the overall network of relationships. This, in turn, may place the actor in a unique position to exert influence in the focal relationship by successfully mobilizing the support of other actors across the network of relationships.

### Dependence Asymmetry and Joint Dependence

In light of our conceptualization of joint dependence and the concomitant logic of embeddedness, we would envision future research on the performance implications of managing interdependence not only at the dyadic level but also at the systemic level. It may be that while increased levels of joint dependence in one relationship benefit its performance due to the logic of embeddedness, they may subsequently have negative implications for the actor's performance of other relationships by perpetuating the logic of power there. Hence, investigating the implications of joint dependence for performance at the level of both dyadic exchanges and the network of relationships appears to be a promising avenue of research. Given the results of our study, a more complete analysis of interdependence will need to give thorough consideration to the structural positions of firms in their networks, providing a more balanced take on the role of relational and structural embeddedness. The complexity of behavioral dynamics underlying interdependence calls for further systematic research attention to the topic.

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